Week 1 Remote Experiment: Chemiluminescence

Earlier in gen chem, you learned that reactions can produce (or absorb) heat. But reactions can also produce energy in the form of light, a phenomenon known as chemiluminescence. You have probably encountered chemiluminescence before in natural or artificial settings: fireflies, bioluminescent sea creatures, and glow sticks all take advantage of this phenomenon.

In this lab we will investigate a common chemiluminescent agent, luminol, to optimize its light-producing qualities. We are researchers at a chemical company that is developing a chemiluminescent product. As such, we need to optimize the product—whatever that means! Will we sacrifice brightness for longer lasting light, for example?

The following reagents are available:

- Luminol (3-aminophthalhydrazide)
- Bleach
- DMSO
- 1 M sodium hydroxide NaOH
- 1 M hydrochloric acid, HCl
- Hydrogen peroxide, H_2O_2

Pre-lab Preparation (Week 1, Tuesday)

Meet with your lab group (via breakout room in Zoom).

1. Decide what qualities you want in your product.
2. Decide on roles for people in your group. One of you will be the timer (to see how long the light lasts), one of you will be the official record keeper (though it's probably a good idea for everyone to keep at least some notes), one of you will be the spokesperson for the group, and one of you will be in charge of managing the conferences.

Lab—Part 1

1. I will demonstrate the combination of the chemicals by combining them two at a time. For example: luminol + bleach, luminol + DMSO… (yes, it is a lot of combinations). We're doing this on a very small scale—only a couple of drops of each! If the reaction produces light, the timer should keep track of how long it lasts. (The stopwatch feature on your smartphone is a good tool for this.)
2. Based on the results in step 1, everyone is allowed to give input on Zoom for what comes next—a combination of three different chemicals. We can try a lot of different combinations.
3. When we're satisfied that we've tried all important combinations of three chemicals, I will work my way up to combos of four (or five) chemicals, all based on input via Zoom.
4. Something to think about as we do this: does order matter? How could we test if it does?

Conference #1

You'll be put into a breakout room with your group. You have ten minutes to discuss the following problem:

Up until now, we've been looking at small-quantity reactions. But no one wants a teeny-tiny light. Decide how your group will scale up the quantities of reagents to fit in a test tube (~10 mL).

Have the spokesperson write the group number and your "recipe" in the Zoom chat once you return to the main Zoom session.

Lab—Part 2

I'll mix up the chemicals for each group in the amounts and order you determine. (I may need the spokesperson to read next steps to me, so be prepared.)

Conference #2

Back in your group's breakout room, discuss whether the product demo went as planned. Do you need to tweak your recipe? Come to a consensus. When the breakout rooms end, post a revised recipe (if necessary) in the chat.

Lab—Part 3

I'll run your recipes for you again.

Lab Report

Take a picture of your lab notebook pages for this experiment and submit them on Canvas

<u>Combined Results/Discussion Section:</u>
Write one paragraph for results/discussion in which you detail how each of the reagents affected the light, what the optimum concentrations of each reagent were, what the final brightness/duration of your light were like, and how you might continue experimenting if you had more time to fine-tune your light.